

REMARKS

The independent claims 1, 36, 51, 58, 59, 60, 66, 69 and 72 along with dependent claims 2-20, 28-30, 33-35, 37-42, 61-65, 67-68, 70-71 and 73-76, were rejected under 35 USC 102(b) as being anticipated by Sun. Dependent claims 21-27, 31-32, and 43-59 were rejected under 35 USC 103(a) as being obvious based on Sun in view of Ganesan. Favorable reconsideration of this application is requested in view of the claim amendments and the following remarks.

102 Rejection

Sun does not teach or suggest Applicant's amended "non-linear gradient field...." In Applicant's response dated Oct. 9, 2003, Applicant provided a distinction of the Sun patent compared to the present claimed subject matter as being based on the non-linearity of the gradient field. It was presented that Sun explicitly assumed a linear gradient along the y-axis. (See Sun, col. 5:40-49.) The y-axis referred in Sun relates to the coordinate system viewed along the borehole, such as in figures 3 and 13 of Sun. Applicant amended its claims to clarify the claimed invention relates to a cases where the gradient in the formation is non-linear. Applicant discusses this fact in its specification, for example, at page 17, line 17 – page 18, line 6, page 21, lines 14-22 and page 25, line 16 – page 26, line 16.

In response to Applicant's arguments, the Examiner cited figs 7, 9, 11 of Sun as a basis for the contrary position that Sun does in fact disclose non-linear gradients. However, figs 7, 9, and 11 show only that the current supplied to the gradient coils is increased over the course of an acquisition sequence. A higher current flow causes the Sun coil to generate a higher gradient. However, the fact that the gradient amplitude can be increased over time pursuant to current pulses does correspond to a non-linear gradient in the formation.

In fact, this relationship between the current pulses to increase the gradient strength is the only variation of gradient that is discussed in Sun. For example, it is not discussed what the effect of a non-linear gradient is on the NMR measurement. Specifically, Sun does not disclose the effect of the gradient in the formation decreasing at one y-coordinate in the formation compared to another y-coordinate in the formation. This discussion is not needed in Sun, which assumes the gradient is linear along the y-axis.

With respect to amended claim 7, Applicant notes that the argument made in its last Response and Amendment was not addressed in the Final Office Action. Specifically, Applicants respectfully assert that Sun does not teach or suggest a magnetic field gradient where "each magnetic field gradient...is oriented circumferentially...relative to the wellbore."

(Applicant's specification, page 17, lines 10-16 and figure 9.) Instead, Sun describes use of four gradient coils, each generating a local gradient field surrounding that particular coil. (Sun, figure 13.) It is the combination of activated coils in Sun which generates the total azimuthal gradient field. (Sun, figure 38.) At least one advantage of Applicant's azimuthal gradient field generated from a single coil is the associated power savings.

With respect to amended claims 12 and 61, the Final Office Action merely refers back to its original citation within Sun. However, the cited portion of Sun at col. 3, lines 2-14 nowhere disclose that an azimuthal image may be resolved using a "single gradient coil." Instead, as previously argued, the Sun disclosure teaches use of multiple gradient coils that require combination to obtain a circumferential image.

Applicant takes a similar position with respect to amended claims 16, 37 and 62. The original citation of Sun at figures 4-18, 20-28, 31-33 and 35-37 nowhere teach or suggest deriving an azimuthal image from two pulse sequences. Instead, as described above, Sun achieves its azimuthal gradient by firing each of its four gradient coils, independently, then again all together. By reducing the number of requisite sequences, Applicants achieve a power savings benefit as well as an improvement in logging speed.

The dependent claims not specifically discussed above are allowable as depending from allowable claims. Based on these comments and the claim amendments, reconsideration of the rejections is respectfully requested.

CONCLUSION

Applicants believe this paper is fully responsive to each and every ground of rejection and objection cited by the Examiner in the Office Action, and respectfully request reconsideration of the application.

Please charge any applicable fees, or apply any excess, to deposit account number 19-0610.

Respectfully submitted,


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Date

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